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[see source for title and abstract in German and English]

Method for Granulating Plastics

This invention relates to a method for granulating plastics.

All the previously known plastic granulation systems work with water temperatures of less than 100°C so that they are limited in their intended purpose and effect for certain tasks.

In strand granulation [pelletization], the strands of plastic are either passed through air first and then into a water bath or they go directly from the nozzle through a water bath and then into the downstream granulation unit.

In water-ring granulation, the material is in a relatively dry state and is cut at the ends and optionally conveyed into a water bath.

For low viscosity plastic materials, so-called belt granulation [dicing] is known; in this method, the droplets of material strike a belt and then are cooled on the belt, thereby producing granules.

In underwater head granulation [pelletization], the plastic material is chopped by revolving blades immediately after emerging from a perforated plate or die plate and then is conveyed further in a stream of water.

Viscosity is a crucial criterion in granulation of polymer plastics. More and more industrial plastics have a tendency to very rapid

solidification in the holes in the perforated plates, if that the cooling

effect of the water flowing by is greater than the heating capacity in combination with the inherent heat of the polymer. A certain temperature difference prevails during granulation, depending on the polymer and its viscosity. Even minor temperature losses in the plastic result in the plastic losing viscosity.

The object of this invention is thus to propose a method with which the temperature difference between the plastic presented for granulation, i.e., the granulated plastic, and the liquid used in granulation is reduced.

This object on which the present invention is based is achieved by the teaching of the main claim and Claim 2.

So-called post-condensation systems are known in the state of the art. With the help of these systems, freshly granulated granules are converted from the amorphous state to the crystalline state. These systems are extremely complex, require a long dwell time and have a high energy consumption and thus also require a high investment cost.

The object of this invention is also to treat fresh granules for a defined period of time in water at a suitable high temperature, i.e., water at a temperature of more than 100°C, to thereby convert the amorphous material into a crystalline material..

This object on which the present invention is based is achieved by

the teaching of the independent Claim 3.

Another means of achieving the object on which this invention is based is defined in Claim 1.

Advantageous embodiments of this invention are characterized in the other subordinate claims.

In other words, it is proposed that either the plastic granules produced in a granulator should be treated directly by performing granulation for a period of time as required for crystallization and that this treatment should be performed in a liquid bath, preferably a water bath at a temperature of more than 100°C.

In another method according to this invention, the plastic is granulated in a water bath at a temperature of more than 100°C, and the plastic granules thus produced are also treated for a period of time as is necessary for crystallization in a liquid bath, preferably a water bath, at a temperature of more than 100°C.

The water bath is provided at a temperature of more than 100°C by heating the water bath to the desired temperature range in an autoclave-like pressure system, so that the high temperature can be achieved, and according to another feature of this invention, the plastic granules in the autoclave-like pressure system are conveyed via a conveyor means.

If the freshly produced granules are introduced into a water bath which is at a temperature of more than 100°C, then post-

condensation can also be performed in water. The granules are

then conveyed either through a suitable air lock into the high temperature water bath or the granulator itself is already situated in a high temperature water bath. After performing the post-condensation, the granules are discharged through appropriate air locks, screen systems and filter systems. At the end of the post-condensation reactor, the granules can be cooled rapidly to the range of 60°C or the like, so that then a finished crystalline product is available in a closed circuit.

The advantage that the granules can be subsequently conveyed out of the reactor into a water bath at a low temperature is also due to the fact that no water vapor subsequently escapes into the atmosphere because this water vapor has previously been condensed in a so-called cooling tank.

A flow chart for the possible implementation of this process is explained below with reference to the drawing.

The drawing shows a granulator unit 1 into which the plastic melt is charged at a suitable temperature and pressure. The granulator unit 1 is installed in a pressure water circuit 2 which is replenished with pressurized water supplied through a pressure water generator 3.

The granules produced in the granulator 1 go into a separation device at 4, where unwanted lumps of granules are separated out and the desired granular fraction together with the pressure water

is conveyed under an appropriate pressure into a second

separation tank 5. A suitable pressurization effect is achieved in the separation tank 4 as well as in the separation tank 5 via a pressure line 6.

The granules from the separation tank 5 go into a holding tank 7, while the water from the separation tank 5 is sent back to the pressure water generator 3, thus creating a closed circuit.

The holding tank 7 forms a crystallization zone 16, and a cooling zone labeled as 8 is optionally present in the lower area of this crystallization zone 16.

The granules mixed with water enter a second circuit 9. Then the granules together with the water are fed into this circuit 9 through a venturi nozzle 10 and next enter a pressure reduction device 11 so that the pressure is regulated down to approximately ∀1 bar.

The granules together with the water go from the pressure reduction device 11 into a separator centrifuge 17; a granule discharge is provided at 12, and the separated water goes through a line 14 to a water processor 15, where the water is heated and the water lost in the process is replenished.

The figure shows the heating devices 18 required for the pressure water generator 3 and the water processor 15 along with the water inlet lines 19.

Patent Claims:

1. Method for granulating plastics, characterized in that the granulation of the plastic takes place in a liquid bath at more than 100°C.

2. Method according to Claim 1, characterized in that a water bath is used as the liquid bath.

3. Method for post-condensation of plastic granules in an amorphous state to convert the plastic to the crystalline state, characterized in that immediately after granulation, the plastic granules produced in a granulator are treated in a liquid bath, preferably a water bath at a temperature of more than 100°C, for a period of time necessary for crystallization.

4. Method for post-condensation of plastic granules in an amorphous state to convert the plastic to the crystalline state, characterized in that the granulation of the plastic is performed in a liquid bath, preferably in a water bath at a temperature of more than 100°C, and the plastic granules thus produced are treated in a water bath at a temperature of more than 100°C for the period of time required for crystallization.

5. Method according to Claims 1, 2, 3 or 4, characterized in that the temperature range of the liquid bath of more than 100°C is achieved in an autoclave-like pressure system.

6. Method according to Claims 3 and 5, characterized in that the plastic granules are conveyed immediately after granulation through an air lock into the autoclave-like pressure system.

7. Method according to Claims 3 and 6, characterized in that the granules are subjected to a water separation before being introduced into the autoclave-like pressure system.

8. Method according to one of the preceding claims, characterized in that the plastic granules together with their residual moisture are conveyed out of the autoclave-like pressure system into a water container at a water temperature of less than 100°C for the purpose of cooling.

9. Method according to one or more of the preceding claims, characterized in that the plastic granules in the autoclave-like pressure system are conveyed via a conveyor means.

[see source for diagrams]